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# Blending Face-to-Face Higher Education with Web-Based Lectures: Comparing Different Didactical Application Scenarios

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**ABSTRACT**

Blended learning as an instructional approach is getting more attention in the educational landscape and has been researched thoroughly. Yet, this study reports the results of an innovation project aiming to gain insight into three different scenarios of applying web-based lectures: as preparation for face-to-face practical exercises, as a repetition of parts of the course, and as an extension of the course. Both the benefits regarding students' satisfaction, perceived educational effects and the effect on student characteristics were investigated. Results indicate that all students evaluate web-based technology as an added value in higher education. Yet, comparison of the three application scenarios showed that web-based lectures are evaluated most positively when used as course preparation whereas when used as course extension, they were appreciated the least. However, there are indications that student characteristics could play a significant role in the level of appreciation of web-based lectures. We conclude that the potential of web-based lectures lies in their adaptability for use in several scenarios according to educational goals.

**Keywords**

Educational technology, Blended learning, Web-based lectures, Higher education, Student characteristics

## Introduction

In the 21th century, a combination of increasing numbers and increasing diversity of the student body in higher education is a worldwide phenomenon (Preston et al., 2010). This is also the case for Flanders, where a report of the Flemish Ministry of Education found not only an increase in higher education intakes but also an increased diversity of students with regard to background, learning style and learning needs (Flemish Ministry of Education, 2012; Verliefde, Vermeyen, & Van Den Bossche, 2010). Academic staff often feels the need for support in teaching these larger and more diverse groups of students (Office for educational quality control at Ghent University, 2012). In this context, there is an interest in increasing flexibility in higher education, which in 2004 led to a Flemish government decree on the flexibility of the organization of higher education. As a consequence of this demand for flexibility, many universities have introduced web-based lectures, comprising learning tools which integrate sound and images and are designed to digitally record lectures for subsequent delivery over the web (Collis & Moonen, 2011; Gosper, Green, McNeil, Phillips, Preston, & Woo, 2008, von Konsky, Ivins, & Gribble, 2009).

Results of previous academic research demonstrates that web-based lectures are most beneficial regarding student' satisfaction and learning outcomes when implemented from a blended learning approach, compared with both traditional face-to-face lectures and fully online modes of education (Day, 2008; Day and Foley, 2006; Howlett et al., 2011; Lim & Morris, 2009; Owston, York, & Murtha, 2013; Taradi, Taradi, Radic, & Pokrajac, 2005). Blended learning is an instructional approach that relies on the mixture of face-to-face and web-based learning environments (Garrison & Kanuka, 2004; Graham; 2006). More specific, research by Chen & Liu (2008) found that dynamic media presentations increase learning efficiency and research of Lai, Tsai, & Yu (2011), in which synchronization of a teacher's lecturing actions for a PowerPoint presentation with his/her voice creates web-based multimedia material which students can use to access past lectures, revealed that students using this technology had more positive learning attitudes and higher achievements than students from the control group. Compared with fully online learning, students of blended courses are more satisfied with the instructional guidance during learning (Lim, Morris, & Kupritz, 2006). It positively impacts students' comprehension and understanding of the learning content (Woo et al., 2008) and students believe that blended courses enable them to gather knowledge from multiple sources (Bliuc,

Ellis, Goodyear, & Piggott, 2011; Orton-Johnson, 2009). Furthermore, students can benefit from increased time and spatial flexibility, wider and easier access to learning sources and a higher level of autonomy in regulating learning (Ashton & Elliot, 2007; Chen & Liu, 2008; Howlett et al., 2011; Owston et al., 2013; Preston et al., 2010).

Despite these overall positive results, some researchers are more cautious and nuanced about this innovation. First, Chong, Tosukhowong and Sakauchi's (2002) and Chen and Liu (2008) pointed to the technical problems which can occur during web-based delivery of content. But more important, von Konsky et al. (2009) reported that the effectiveness of web-based lectures was not uniform for all students. Concerning this issue, research of López-Pérez, Pérez-López and Rodriguez-Ariza (2011) and Owston et al. (2013) found that compared with lower achieving students, high achievers were the most satisfied with the blended learning approach and it is questioned whether blended learning is as suitable for low achievers as they may not have the independent study skills that blended learning demands.

Moreover, it can be noticed that most literature discusses web-based lecture technology in general without specifying the intended purposes when introducing web-based lectures in education. However, based on the principle of Constructive Alignment, a term coined by Biggs (1996), we believe that it is important to reflect what a teacher want from his/her course and how to provide appropriate teaching and learning activities to reach the objectives. Next to Biggs, also other authors have used this term and it was Fink (2003) who visualized constructive alignment as the triangular model depicted in Figure 1. The basic premise is that courses need to be designed so that the learning activities and assessment tasks are aligned with the learning objectives that are intended in the course. Marinissen & Gratama Van Andel (2012) building on these key components presented different didactic applications of web-based lectures, and showed that they can be used in various contexts, depending on the educational goals lecturers want to reach with their students.

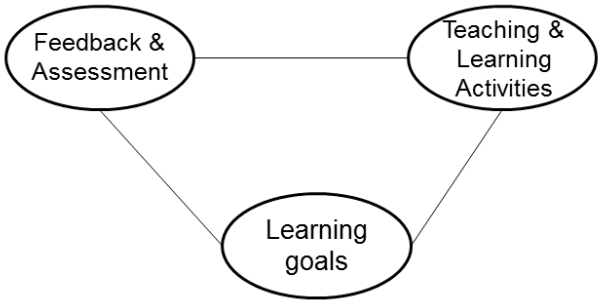


*Figure 1*. The key components of *Constructive Alignment* (Biggs, 1996) visualized by Fink (2003)

The goal of this paper is to investigate and compare students' perceptions about the benefits of the web-based lectures implemented with different didactical intended purposes and resulting in different application scenarios. Moreover, it is questioned to what extent these perceptions are influenced by students' personal characteristics and how this interacts with the application scenarios. To this end, web-based lectures were designed and implemented complementary to face-to-face activities. Although the web-based lectures were technically identical, they differed regarding the pedagogical intended purpose and resulted in three application scenarios: (1) web-based lectures as a means of preparation for the face-to-face practical exercises, (2) as a means of repetition of parts of the course, and (3) as a means of extension to supplement classroom lectures.

**Research questions**

The following research questions were investigated regarding the three case studies:

- What are students' expectations about web-based lectures?
- How do students evaluate the quality of the web-based lectures and how frequently do they watch them?
- What are students' perceptions concerning the benefits for learning after using the web-based lectures and how does these differ from their pre-experience expectations?
- Are students' evaluations of web-based lectures affected by their individual characteristics (i.e., gender, learning style, and learning strategy)?

## Methods

### Context and participants

This study was conducted in the context of an educational innovation project involving three courses taught at the Faculty of Sciences at Ghent University (see Figure 1). The participants were 427 students in the Faculty who were taking one of the following three courses: "Geographical Information Systems" (*N* = 88 students, 53% male students), "Molecular Biology 1" (*N* = 76 students, 47% male students), and "Mathematics 1" (*N* = 263 students, 57% male students). In the Geography course, web-based lectures were used as a means of a preparation for practical exercises, in "Molecular Biology 1" they were used as a means of a repetition of parts of the course and in "Mathematics 1" as a means of an extension of the course. All web-based lectures were slide-based presentations recorded by means of "Camtasia Studio" screen recording software. As depicted in Figure 2 the software simultaneously captures the video image and audio of the lecturer along with his or her electronic slide presentation. The web-based lectures were subsequently provided via Minerva, the electronic learning environment for students of Ghent University.

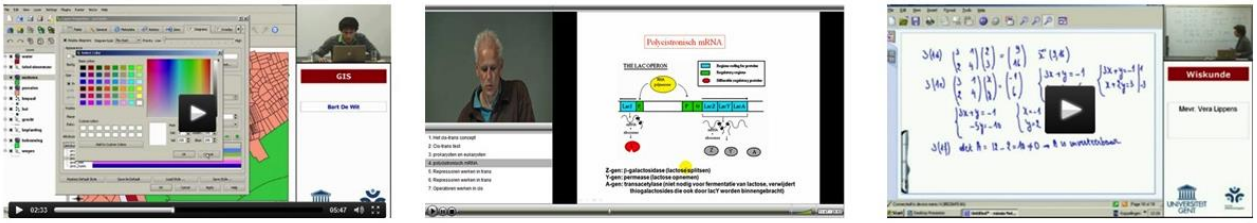


*Figure 2*. Screenshots of the web-based lectures captured by means of "Camtasia Studio" screen recording software and provided to students. From left to right: Geographical Information System (GIS), Molecular Biology 1, and Mathematics 1

### Design and procedure

Since students on the different courses were each provided with web-based lectures for different application scenarios, as shown in Figure 3, this study is conducted as a case study design to investigate students' expectations by means of an intake questionnaire (pre-test) and students' perceived benefits for learning by means of an exit questionnaire (post-test). Due to the ethical prohibition against withholding benefits from one group of participants (Robson, 2002), a controlled design with random assignment of students within each case was not possible.

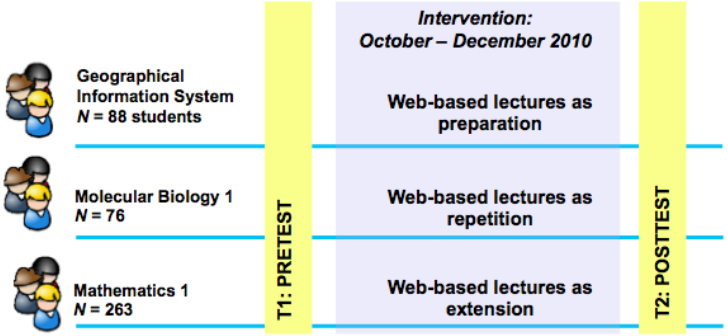


*Figure 3*. The pre- and post-test design to compare web-based lectures with different application scenarios in authentic higher education

### Web-based lectures as preparation - Geographical Information System (GIS)

The second-year "Geographic information system (GIS)" course in the BSc in Geography comprised theoretical lectures and seminars (coached exercises) during which students (*N* = 88) had to work on assignments using GIS-

software. Since the teacher experienced to lose a lot of time to get to learn how to work with the GIS software program, web-based lectures were introduced to students as a way of giving them the opportunity to prepare themselves for the exercises in the class sessions, so that there would be more time to actually work on the exercises in the class sessions. Twenty introductory lessons to the exercises (max. 15 minutes each), explaining features of the software used in the seminars, were recorded as web-based lectures in a studio by the university's Institute for Permanent Development using Camtasia software, with a teaching assistant serving as lecturer. Students were encouraged by the teaching assistant to prepare themselves for the seminars by viewing these web-based lectures beforehand. In addition, students could use headsets during the seminars, so that they could replay the web-based lectures at will. In this way, students could do the exercises at their own pace, replaying if things were unclear. The teaching assistant was present in the classroom to answer questions. The web-based lectures used in this condition were thus an integral part of the course.

Students were invited to participate in the study and to fill out the intake and exit questionnaires during class sessions. In total 40 students completed both questionnaires which resulted in a response rate of 45%.

**Web-based lectures as repetition - Molecular Biology 1**

The "Molecular Biology 1" course comprised theoretical lectures in molecular biology. Based on previous examinations, it was found that some topics were more difficult than others resulting in low examination scores. Based on this finding, three course topics have been selected for recording, that is "the cis-trans concept," "the Wobble effect," and "the alpha-complementation." These web-based lectures gave students the opportunity to re-listen to these difficult parts of the course at home. The lecturer was the course professor. The lectures were recorded in a studio using Camtasia software. They ranged from 15 to 25 minutes and were provided to 76 students of the second year BSc in Biochemistry and Biotechnology. All students had the same prior knowledge concerning the topics covered. The web-based lectures were available to the students as soon as the topic had been covered in the face-to-face lecture. In this case, then, the web-based lectures were a duplication of parts of the lectures and served as repetition. Additional material to enhance the understanding of the course included scientific articles and movies on selected topics (e.g., DNA replication).

Because the web-based lectures had already been provided to the students at the start of this study, a pre-questionnaire was not administered (student expectations were irrelevant). However, at the end of the course students were invited to participate in the study by filling in the post-questionnaire using the url link. To increase the response rate, students who had not done so within one week were encouraged to fill in the questionnaire on paper during a lecture. In total 51 students completed the post-course questionnaire which resulted in a response rate of 67 %.

**Web-based lectures as extension – Mathematics 1**

The "Mathematics 1" course included both theoretical lectures and seminars (coached exercises). Students could prepare themselves for these seminars by making exercises at home. These exercises were placed on Minerva a week in advance, so students had one week to complete them. After the seminar, during which the practical assistant made the exercises on the black board and discussed them thoroughly, the solutions were placed on Minerva as well. Yet, since the teacher indicated that the students group has over the years evolved into a very diverse group with regard to background meaning that some students had had more than 6 hours while other students only have had 3 hours mathematics during secondary education, web-based lectures were additionally introduced to make remediation possible. Web-based lectures were designed as supplementary material to the seminars. Four weeks prior to the end-of-course examination, 65 web-based mini lectures, ranging from 5 to 10 minutes, were provided online to 263 first-year BSc students in Biology, Geology, Biochemistry, Biotechnology, and Geography. In these web-based lectures, the solutions to questions of the last two years' exam were given, in preparation for the exam to come. A teaching assistant, who served as lecturer, worked through the problems on the whiteboard and explained the steps to come to the solutions (verbally). The web-based lectures were recorded in a studio by the Institute for Permanent Development of Ghent University using Camtasia and Mimio technology. Here, then, the web-based lectures served as an extension of the course material.

Compared to the student population of the other two courses, the students following the "Mathematics 1" course formed a very heterogeneous group. Their prior secondary-level mathematics education ranged from two to eight hours a week. In their last year of secondary education, 32 % had had 2, 3 or 4 hours of mathematics per week while 56 % had had 6, 7 or 8 hours. This learner characteristic was included in the analysis as an extra variable to answer the fourth research question.

Students were invited to participate in the study and to fill in the pre- and post questionnaire online. One week later, to increase the response rate, students who had not filled in the online questionnaire were encouraged to do so on paper during the class session. In total 135 students completed the two questionnaires which resulted in a response rate of 51%.

## Measurements and analysis

As shown in Table 1, the pre- and post questionnaires consisted of several sections based partly on existing scales. They were available to complete online through the LimeSurvey software tool, which students accessed via a web link sent in an email invitation, or on paper during face-to-face sessions.

*Table 1.* Structure of the pre- and posttest questionnaire

| Pretest | Posttest |
|---|---|
| • Students' background characteristics<br>• Students' learning strategy and motivation (based on MSLQ)<br>• Students' learning style (VARK)<br>• Students' prior expectations about web-based lectures | • Students' background characteristics<br>• Students' use and experiences of the provided web-based lectures<br>• Perceived benefits for learning and added value of the web-based lectures |

Students' background characteristics comprised gender, academic status (first or second year of undergraduate studies) and students' prior mathematics education in the final year of secondary education. Students' learning strategy and motivation was subsequently measured by means of three selected subscales from the Motivated Strategies for Learning Questionnaire (MSLQ) of Pintrich, Smith, Garcia, and McKeachie (1991), which has been successfully utilized in previous educational research (Opdecam, Everaert, Van Keer, & Buysschaert, 2014; Schunk, 2005). The original version of the MSLQ is in English, but we used the Dutch items translated from the original questionnaire using the back translation method of Opdecam et al. (2014). The first selected motivational subscale included in this study is *extrinsic goal orientation* to measure the extent to which students focus on grades and approval from others. Second, students' *control of learning beliefs* was measured and third, students' *self-efficacy for learning and performance*, to gauge how students expected and believed that they would perform regarding this particular course. (See Appendix A for the three subscales with the accompanying items and Chronbach's alphas). The scales were rated on a 7-point Likert scale (1 completely disagree – 7 completely agree.)

Next, to measure student's learning style, we used the 16-item VARK Questionnaire (Fleming & Mills, 1992). VARK stands for Visual, Aural, Read/Write and Kinesthetic and pertains to students' different styles of learning. For 16 different provided situations students need to choose the answer which best explains their learning preference; they can tick more than one if a single answer does not match their perception. Consequently, the VARK questionnaire provides users with a profile of their learning preferences and told us something about the way our students tended to take-in and give-out information.

The post-questionnaire gauged students' use and experiences of the provided web-based lectures and more particularly their perceptions of its benefits for learning and the organization of learning. The different items can be found in the tables in the results section. The post-questionnaire ended with an open answer question to generate more general comments and feedback.

In addition to the primary data from the students' perspective, we also administered a small lecturer questionnaire concerning their expectations and experiences of the web-based lectures in order to generate feedback to inform future applications (Appendix B). The results of this are integrated into the discussion below.

## Results

### Web-based lectures as preparation

*Expectations*

First of all, *the expectations* of students about using web-based lectures in courses were investigated. Based on a one-sample t-test, the data revealed whether they were significantly higher than the neutral score of "4" (on a 7-point Likert scale). As shown in Table 2, the conclusion can be made that students had high expectations about the benefits of web-based lectures. They believed that web-based lectures would be useful for learning independent from time and geographical location, would help them to prepare for exams and, as preparation for classes, would help them to better understand the content and to achieve better results. All these variables are significantly higher than the neutral score. However students did not expect that their motivation would be improved by using web-based lectures.

*Table 2.* Students' expectations of benefits of web-based lectures: Pretest results scored on 7-point Likert scale ($N$ = 40)

| Web-based lectures… | $M$ ($SD$) | $t$ (39) | $p$ -value (test value = 4) |
|---|---|---|---|
| … will lead to better understanding of the content. | 4.90 (1.37) | 4.14 | .00 |
| … will help me to prepare for exams. | 5.25 (1.32) | 6.01 | .00 |
| … makes learning independent from time and geographical location. | 5.45 (1.08) | 8.45 | .00 |
| … will help me to achieve better results. | 4.70 (1.26) | 3.50 | .00 |
| … will increase my motivation for the course. | 4.23 (1.51) | .94 | .35 |
| … have an added value in higher education. | 5.28 (1.04) | 7.77 | .00 |

*Experiences*

Regarding students' *experiences* with the web-based lectures provided (see Table 3), it was found that students had no technical problems while using them. In addition, students reported good image quality and sound quality. Descriptives indicate that 95% of the students in this condition had watched the web-based lectures more than once; the mean ($M$ = 4.83, $SD$ = .68) is also very high (on a 5-point Likert scale). Comments were also positive: "I watched the web lecture because the content was well explained with illustrations," "I watched the web-based lectures because I want to understand the course," "Web-based lectures give us important information," and "Everything was explained well."

*Table 3.* Students' experiences with web-based lectures: Posttest results scored on 7-point Likert scale ($N$ = 40)

| The provided web-based lectures… | $M$ ($SD$) | $t$ (39) | $p$-value (test value = 4) |
|---|---|---|---|
| … had good picture quality. | 6.05 (1.31) | 11.40 | .00 |
| … had good sound quality. | 5.90 (1.15) | 10.45 | .00 |
| … were easy to watch on the Internet, without technical problems. | 6.03 (1.25) | 10.24 | .00 |

*Perceived benefits for learning*

In this section, *a comparison* between these high *expectations* and students' *evaluations* after using web-based lectures as preparation of lessons is made. To investigate this, paired sample t-tests were conducted. Results (see Table 4) show that students were more positive than their original expectations with regard to the statement "Web-based lectures will help me to better understand the content." Students were also more positive in their evaluation about the possibility of learning independently from time and geographical location.

*Table 4.* Students' expectations and evaluations of benefits of web-based lectures: Pretest and posttest results compared (7-point Likert scale; $N = 40$)

| Web-based lectures… | Pretest | Posttest | Difference | |
|---|---|---|---|---|
| | *M* (*SD*) | *M* (*SD*) | *t* (39) | *p*-value |
| … has led to better understanding of the content. | 4.90 (1.37) | 5.80 (1.37) | -3.20 | .01 |
| … will help me to prepare for exams. | 5.25 (1.32) | 5.83 (1.45) | -1.70 | .09 |
| … makes learning independent from time and geographical location. | 5.45 (1.08) | 6.05 (1.26) | -2.42 | .02 |
| … will help me to achieve better results. | 4.70 (1.26) | 4.90 (1.36) | -.83 | .41 |
| … has increased my motivation for the course. | 4.23 (1.51) | 4.48 (1.52) | -.87 | .39 |
| … have an added value in higher education. | 5.28 (1.04) | 5.23 (1.46) | .21 | .83 |

Next, based on a one sample t-test (see Table 5), students in this condition indicate that using web-based lectures have an added value for revising course content, opens up the accessibility for students with special needs, and can help to deepen knowledge.

*Table 5.* Students' overall appreciation of added value of web-based lectures: Posttest results scored on 7-point Likert scale ($N = 40$)

| The provided web-based lectures… | *M* (*SD*) | *t* (39) | *p*-value (test value = 4) |
|---|---|---|---|
| … are an added value for making revision possible. | 6.05 (1.20) | 10.93 | .00 |
| … can open up the accessibility for students with special needs. | 5.75 (1.19) | 9.28 | .00 |
| … can help students to deepen knowledge | 5.29 (1.52) | 5.31 | .00 |

*Impact of students' characteristics*

As an answer to the 4th research question, and based on a Multiple ANOVA analysis (MANOVA), no significant effects of *individual characteristics* (i.e., gender, learning style, and learning strategy) on students' evaluation of web-based lectures as preparation ($p > .05$) were found (see Table 6). In addition, but in contrast with this finding, the interviewed lecturer of this course stated that web-based lectures make students responsible for their own learning process, which turns out to be positive for some students, while other perform worse.

*Table 6.* Impact of students' characteristics: Results of Multiple ANOVA analysis

| Impact of student characteristics | Wilks' Lambda | *F* (10,25) | *p*-value |
|---|---|---|---|
| Gender | .72 | .94 | .51 |
| Learning style | .71 | 1.00 | .47 |
| Extrinsic goal orientation | .80 | .65 | .76 |
| Self-efficacy for learning and performance | .60 | 1.64 | .15 |
| Control of learning beliefs | .70 | 1.07 | .42 |

## Web-based lectures as repetition

Since this group had already started the course at the start of the survey, we can only focus on research question 2 to 4.

*Experiences*

When focusing on the *evaluation* of their experience with the web-based lectures, significant positive results can be noticed. Students confirmed that using web-based lectures as repetition helped them to better understand the content of the course ($M = 5.38$, $SD = 1.58$, $t(31) = 5.62$, $p < .001$) and they agreed that it could help them to be better prepared for exams ($M = 5.68$, $SD = 1.48$, $t(30) = 6.01$, $p < .001$). Students also confirmed the benefit of studying independently from time and geographical location ($M = 4.38$, $SD = 1.84$, $t(30) = 3.19$, $p < .05$). No significant effects were found regarding the perceived learning outcomes ($M = 4.32$, $SD = 1.68$, $t(30) = 1.07$, $p > .05$) nor

students perceived web-based lectures as a means to increase the motivation for the courses ($M$ = 3.71, $SD$ = 1.49, $t(30) = -1.09$, $p > .05$).

Students had no technical problems using web-based lectures ($M$ = 5.10, $SD$ = 1.58, $t(30) = 8.42$, $p < .001$) and reported good image quality ($M$ = 5.87, $SD$ = 1.20, $t(30) = 3.97$, $p < .001$) and sound quality ($M$ = 5.81, $SD$ = 1.20, $t(30) = 8.65$, $p < .001$). Means of the frequency of watching the web-based lectures in this format were low ($M$ = 2.63, $SD$ = 1.66), with 53% of the students not watching them more than once. When asking for the reasons behind this low score, students reported: "no time," "the web-based lectures are not necessary," "superfluous." However, a minority reported contradictory evaluations: "the movies were clearer than the other course materials," "they visualized the content," and "they have an added value for preparation of exams." Moreover, after using the web-based lectures, students in this course agreed with the statement that using web-based lectures was an added value for making revision possible ($M$ = 5.29, $SD$ = 1.46, $t(40) = 5.33$, $p < .001$), opens up accessibility for students with special needs ($M$ = 5.06, $SD$ = 1.52, $t(40) = 4.43$, $p < .001$) and can help to deepen knowledge ($M$ = 5.07, $SD$ = 1.57, $t(40) = 4.37$, $p < .001$). In addition, the interviewed lecturer of this course agrees with the statement that using web-based lectures in this way is an effective tool for increasing understanding of the course. He was very positive about this experience with the web-based lecture and professed an interest in making more recordings in the future.

*Impact of students' characteristics*

Because of the lack of data on learning style and learning strategy, only gender could be included in this part of the analysis. Results indicate no relation between learning characteristics and using web-based lectures as repetition (Wilks' Lamba = .72, $F(13, 17) = .52$, $p > .05$).

## Web-based lectures as extension

*Expectations*

Students' *expectations* about using web-based lectures in this condition were also higher than the neutral "4", using one sample t-tests. These data indicate that students agreed that using web-based lectures as an extension of the course would be an added value ($M$ = 5.10, $SD$ = 1.08, $t(130) = 1.65$, $p < .001$) and that they would be better prepared for exams ($M$ = 5.37; $SD$ = .99, $t(130) = 15.93$, $p < .001$). They also agreed that using web-based lectures would be useful for better understanding course content ($M$ = 5.00, $SD$ = 1.03, $t(130) = 11.11$, $p < .001$), for learning independently of time and geographical location ($M$ = 4.70, $SD$ = 1.14, $t(130) = 9.71$, $p < .001$)) and for achieving better results ($M$ = 4.78, $SD$ = 1.09, $t(130) = 8.17$, $p < .001$). All these variables were significantly higher than the neutral score of "4" ($p < .001$). On the other hand, students did not expect web-based lectures to improve their motivation to learn ($M$ = 4.20, $SD$ = 1.22, $t(130) = 1.86$, $p > .05$).

*Experiences*

When using web-based lectures for this purpose, students *experienced* no technical problems ($M$ = 5.33, $SD$ =1.15, $t(116) = 10.76$, $p < .001$) and reported strong picture quality ($M$ = 5.32, $SD$ = 1.17, $t(116) = 12.60$, $p < .001$) and sound quality ($M$ = 5.18, $SD$ = 1.87, $t(116) = 12.30$, $p < .001$). Only 20% of the students in this condition reported watching the web-based lectures more than once and more than 88% of them reported watching half of the web-based lectures or even less. In fact, qualitative data show us that most students report not watching the web-based lectures at all, some because of lack of time. Two students stated that they watched only some parts of the lectures since a 20 minute lecture was found to be too long to watch. Another student indicated that he only watched a part of the lecture out of curiosity.

*Perceived Benefits for learning*

In contrast to the condition in which web-based lectures were used as course preparation, paired sample t-tests reveal that in this condition *expectations* before using web-based lectures were significantly higher than the *evaluation* afterwards (see Table 7).

*Table 7.* Students' expectations and evaluations of benefits of web-based lectures: Pretest and posttest results compared (7-point Likert scale; $N = 51$)

| Web-based lectures… | Pretest | Posttest | Difference | |
|---|---|---|---|---|
| | *M* (*SD*) | *M* (*SD*) | *t*(110) | *p*-value |
| … has led to better understanding of the content. | 5.04 (1,01) | 4.07 (1.57) | 3.41 | .00 |
| … will help me to prepare for exams. | 5.43 (1.00) | 4.62 (1.55) | 5.44 | .00 |
| … makes learning independent from time and geographical location. | 4.97 (1.16) | 4.10 (1.49) | 6.06 | .00 |
| … will help me to achieve better results. | 4.81 (1.10) | 3.49 (1.37) | 10.66 | .00 |
| … has increased my motivation for the course. | 4.22 (1.22) | 3.40 (1.38) | 5.57 | .00 |
| … has an added value in higher education. | 5.10 (1.09) | 4.76 (1.49) | 2.47 | .02 |

However, these results should be nuanced. When students on this course were asked for a final evaluation of using web-based lectures, results are more positive. These students report that web-based lectures are an added value for making revision possible ($M = 5.07$, $SD = 1.28$, $t(126) = 9.43$, $p < .001$) and improve accessibility for students with special needs ($M = 5.31$, $SD = 1.21$, $t(126) = 12.22$, $p < .001$). In addition, the interviewed lecturer of this course agrees with the statement that web-lectures support students to prepare exams more effective. Compared with these high evaluation scores, students produced lower scores on the question of whether web-based lectures can help to deepen knowledge ($M = 4.78$, $SD = 1.39$, $t(126) = 6.34$, $p < .001$).

*Impact of students' characteristics*

In a final step, significant effects of self-efficacy (negative effect) (Wilks'Lambda = .80, $F(10, 94) = 2.39$, $p < .05$) and expectancy (Wilks' Lambda = .80, $F(10, 94) = 2.36$, $p < .05$) on the evaluation of web-based lectures as an extension were found. This means that students who did not themselves believe that they would pass the course and students who scored high on control of learning beliefs have a significantly higher change to perceive web- based lectures as an added value. Moreover, it was found that students' ability profile / prior knowledge (operationalized by the number of hours of mathematics received in secondary education) had an effect on the appreciation of the provision of web-based lectures as an extension. Students who had had less than 6 hours of mathematics per week in secondary education reported that using web-based lectures helped them to better understand the subject matter to a greater extent than did students who had received 6 or 8 hours weekly ($M_{<6} = 4.49$, $M_{6\text{-}8} = 3.77$), $t(112) = -2.40$, $p < .05$).

The former group also found web-based lectures more useful for preparing for exams ($M_{<6} = 4.91$) than did the latter group ($M_{6\text{-}8} = 4.35$, $t(112) = -.871$, $p = .064$ (marginally significant).

## Discussion and conclusion

The goal of this study was to investigate and compare students' perceptions about the benefits of the web-based lectures with different didactical intended purposes and resulting in different application scenarios. Moreover, prior to the research reported in this paper, little specific research such as López-Pérez et al. (2011), Owston et al. (2013) and von Konsky et al. (2009) has been done to study the impact of individual student characteristics on the evaluation of different scenarios of applying web-based lectures. Our results indicate that overall students evaluate this kind of technology as an added value. This confirms previous research which has pointed to the general benefits of using web-based lectures to complement face-to-face courses (Day, 2008; Day & Foley, 2006; Howlett et al., 2011; Lim & Morris, 2009; Owston et al., 2013; Taradi et al., 2005). In particular, research shows that web-based lectures are seen as an added value for making revision possible (Lai et al., 2011), help students to learn independent from time and geographical location (Ashton & Elliot, 2007; Chen & Liu, 2008; Howlett et al., 2011; Owston et al., 2013; Preston et al., 2010) and provide the possibility of helping to deepen knowledge (Woo et al., 2008).

When comparing different scenarios of applying web-based lectures, our results suggest that the web-based lectures used as a means of course preparation is evaluated most positively. Web-based lectures are appreciated the least

when used as a means of course extension. However, regarding the latter, results need to be nuanced by taking into account student characteristics. It has been found that students with a poor background and low self-efficacy for mathematics and an internal locus of control have a significantly higher appreciation for the application of web-based lectures as a means of extension. This means that web-based lectures as a means of extension are especially beneficial for low-achieving students. This was however not the case when web-based lectures were implemented as a means of preparation since the lecturer of the GIS course noticed that while web-based lectures enhanced flexibility for the student and made them responsible for their own learning process, this feature was positive for some students but negative for others. This is consistent with the concerns of López-Pérez et al. (2011) and Owston et al. (2013) that web-based lectures would not be suitable for low-achievers as they may not have the independent study skills that blended learning demands. These results support the indications of von Konsky et al. (2009) and stress the need for further research regarding the impact of individual characteristics regarding different scenarios of applying web-based lectures.

Based on these results, the following conclusions with respect to the application of web-based lectures in education can be drawn. First of all, interviews with the course lecturers in our study revealed that perceiving the integration of web-based lectures as an added value depends on the intended purposes of the course. Every application of web-based lectures can be an added value, as long as the desired educational goal is taken into account which is consistent with the concept of "constructive alignment" (Biggs, 1996). Using web-based lectures as a repetition is most beneficial when lecturers want to provide the opportunity for students to repeat difficult lectures and concepts. Using them as preparation is most beneficial for lecturers who want to save time by replacing basic lessons with recordings for students to watch at home and to provide more time for exercises and the possibility of answering questions during the limited time available for face-to-face lessons. Finally, using web-based lectures as an extension of the course can be most beneficial for students who need more exercises or for those who want a deepening of the course content. Secondly, student characteristics can play a significant role and should be taken into account when introducing web-based lectures. In this respect, web-based lectures are a way to differentiate and meet the needs of all students in higher education. Thirdly, and in contrast to the findings of Chen & Liu (2008), students in all courses in our study reported to experience no technical problems while using web-based lectures. Once lectures have access to, or purchased, screen recording software (e.g., "Camtasia Studio"), they can easily start creating web-based lectures. Hence, using this technology does not imply the need for lecturers and students to learn difficult technical skills before they can use this technology for educational activities. Concluding, the potential of web-based lectures lies in its adaptability for use in several scenarios according to the needs of students and the didactical intended purposes.

## Limitations and further research

A limitation of our study is the absence of a control group. Another limitation was the absence of pre-test data in the group where web-based lectures were used as a repetition, because the course had already begun at the start of the survey. Therefore, no clear conclusion about learning style could be made.

In this study we measured students' satisfaction and perceived educational effects of the application of web-based lectures from different scenarios, in future research it would be interesting to study the effects on student achievement as well.

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**Appendix A**

| Subscales with corresponding items based on the original MSLQ (1 completely disagree – 7 completely agree) | Cronbach's alpha |
|---|---|
| *Extrinsic goal orientation*<br>1. Getting a good grade in this class is very important for me.<br>2. If I can, I want to get better grades in this class than most of the other students.<br>3. I want to do well in this class because it is important to show my ability to my family and friends | 0.74 |
| *Control of learning Beliefs*<br>1. If I study in appropriate ways, then I will be able to learn the material in this course.<br>2. It is my own fault if I don't succeed in this course.<br>3. If I try hard enough, then I will understand the course material.<br>4. If I don't understand the course material, it is because I didn't try hard enough. | 0.74 |
| *Self-Efficacy for Learning & Performance*<br>1. I believe I will receive an excellent grade in this class.<br>2. I'm certain I can understand the most difficult material presented in the readings for the course.<br>3. I'm confident I can learn the basic concepts taught in this course.<br>4. I'm confident I can understand the most complex material presented by the lecturer in this course.<br>5. I'm confident I can do an excellent job on the exam of this course.<br>6. I expect to do well in this class.<br>7. I'm certain I can master the skills being taught in this class.<br>8. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class. | 0.94 |

**Appendix B**

| Questionnaire for the lecturers |
|---|
| *General questions*<br>1. Name and course where you implemented web lectures:<br>2. What was the purpose of the application of web lectures? What were your expectations?<br>3. Did the application of web lectures meet your expectations? Why / Why not?<br>4. Did any technical or organizational problems arise? Explain.<br>5. Would you use web lectures again in the future? Why/Why not?<br>6. What aspects can be improved? |
| *Give your opinion on the following statements*<br>5. The use of web lectures is an effective aid to enhance the understanding of the course.<br>6. Students perform better using the web lectures. |